ANNEX E
SITE-SPECIFIC MONITORING PLAN
FOR THE EXPLOSIVE DESTRUCTION SYSTEM
AT DUGWAY PROVING GROUND

U.S. Army
Chemical Materials Agency

Project Manager for
Non-Stockpile Chemical Materiel

Site-Specific Monitoring Plan for the Explosive Destruction System at Dugway Proving Ground

Final
Revision 2

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1. INTRODUCTION

This document presents a site-specific plan for air and waste monitoring at the site of the Explosive Destruction System (EDS) operating at Dugway Proving Ground (DPG), Utah. This plan addresses the monitoring requirements as specified in the U.S. Army Chemical Materials Agency (CMA) *Programmatic Monitoring Concept Plan* (MCP), the CMA *Programmatic Laboratory and Monitoring Quality Assurance Plan* (LMQAP), and the Edgewood Chemical Biological Center (ECBC) Environment Monitoring Laboratory, *Laboratory and Monitoring Quality Control Plan for Chemical Materials Agency (CMA) and for Chemical Agent Standard Analytical Reference Material (CASARM)*. Hereafter this document will be referred to as the LMQCP.

1.1 Background

An EDS unit will be sited at DPG and used to treat chemical agent-filled and empty items currently in storage in Igloo G. The munitions have been x-rayed and assessed by portable isotopic neutron spectroscopy (PINS) and the results were reviewed by the Materiel Assessment Review Board (MARB).

Explosive charges will be used to access the items and the chemical agent fill treatment will be accomplished using neutralization technologies.

The general personal protective equipment (PPE) to be worn during EDS operations will be Level C. However, all monitoring will be performed at levels required for unmasked workers, designated as “no respiratory protection” in the airborne exposure limit (AEL) tables.

A typical operational day will be for a duration of 10 to 12 hours. All MINICAMS® will operate continuously; however, MINICAMS units will not be challenged during non-operational hours. At no time during operations will chemical agent or chemical

agent products be stored onsite in the Environmental Enclosure (EE) during non-operational hours.

1.2 Purpose

The purpose of this monitoring plan is to provide the strategy to be used by ECBC to monitor for potential airborne vapor concentrations and generated waste products for the chemicals of concern during operations of the EDS at DPG.

1.3 Scope

The air monitoring plan establishes monitoring objectives, procedures, and responsibilities for the execution of a monitoring program at DPG. Monitoring strategies used to support EDS operations at DPG are based on the following assumptions:

- The chemical materiel contents of each item have been identified.
- Items will be processed in chemical agent campaigns.
- The EDS unit will be located in an EE.

1.4 Chemicals of Concern

During operations at DPG, the EDS will be used to destroy items filled with distilled sulfur mustard (HD), thickened mustard (HT), O-ethyl S-(2-diisopropylaminoethyl) methylphosphonothioate (VX), soman (GD), and sarin (GB).

1.5 Monitoring Objectives

Chemical materiel monitoring during EDS operations is performed to ensure that chemical materiel operations are being safely conducted and to detect any conditions that may cause a release of chemical materiel. Monitoring of the site during treatment activities will accomplish the following:

- Provide worker protection.
- Protect the environment from a potential chemical agent release.
- Provide early warning to decision-makers for implementation of corrective action(s).
- Verify treatment activities are complete.
- Verify cleanup activities satisfy necessary performance standards.

For chemical agents, exposure limits are based on maximum concentration values not to be exceeded for a given period of time, depending on the level of protection worn by personnel. In general, unmasked workers should not exceed the unmasked worker time/concentration short-term exposure limit (STEL) and/or worker population limit (WPL) value. Exposure limits are provided in **Tables E-1**, **E-2**, **E-3**, and **E-4**.

Table E-1. HD/HT AELs

HD/HT	Averaging Time						
	GPL (12 hours)	WPL (12 hours)	WPL (8 hours)	WPL (4 hours)	WPL (2 hours)	STEL[a] (15 minutes)	Variable
General Population	2×10^{-5} mg/m^3						
No Respiratory Protection		2.7×10^{-4} mg/m^3	4×10^{-4} mg/m^3	8×10^{-4} mg/m^3	1.6×10^{-3} mg/m^3	3×10^{-3} mg/m^3	
Air-Purifying Respirator	Use only in accordance with Army/NIOSH approval and restrictions on use.						
Supplied-Air Respirator w/o Escape Bottle		0.27 mg/m^3	0.4 mg/m^3	0.4 mg/m^3	0.4 mg/m^3	0.7 mg/m^3	
Self-Contained Breathing Apparatus or Supplied-Air Respirator with Escape Bottle		2.7 mg/m^3	4 mg/m^3	8 mg/m^3	16 mg/m^3	30 mg/m^3	
Vapor Screening Limit							3×10^{-3} mg/m^3

Notes:

[a] Exposures at the STEL shall occur not more than one time per day. The Centers for Disease Control and Prevention (CDC) may publish updated numbers.

Airborne exposure limits (AELs) are taken from the CMA MCP and 69 FR 24164-24168 (3 May 2004).

Table E-1. HD/HT AELs (Continued)

Notes: (Continued)

All AELs are concentration and time values, not concentration only values. Administrative controls may be used to limit potential exposure to workers. However, because administrative controls cannot be used to limit the duration of potential public exposure, only the WPL protective action level is significantly affected by administrative controls, which limit the duration of potential exposure.

The maximum use concentration is the product of the AEL and the assigned protection factor for the respirator. The assigned protection factors used in this table are taken from 68 FR 34036-34119, 6 June 2003. For sulfur mustards, air-purifying respirators are for escape purposes only.

GPL = general population limit
HD = distilled sulfur mustard
HT = thickened mustard
mg/m^3 = milligram per cubic meter
NIOSH = National Institute for Occupational Safety and Health
STEL = short-term exposure limit
WPL = worker population limit

Table E-2. VX AELs

VX	Averaging Time						
	GPL (24 hours)	WPL (12 hours)	WPL (8 hours)	WPL (4 hours)	WPL (2 hours)	STEL[a] (15 minutes)	Variable
General Population	6×10^{-7} mg/m^3						
No Respiratory Protection		6×10^{-7} mg/m^3	1×10^{-6} mg/m^3	2×10^{-6} mg/m^3	4×10^{-6} mg/m^3	1×10^{-5} mg/m^3	
Air-Purifying Respirator		3×10^{-5} mg/m^3	5×10^{-5} mg/m^3	1×10^{-4} mg/m^3	2×10^{-4} mg/m^3	5×10^{-4} mg/m^3	
Supplied-Air Respirator w/o Escape Bottle		6×10^{-4} mg/m^3	1×10^{-3} mg/m^3	2×10^{-3} mg/m^3	4×10^{-3} mg/m^3	1×10^{-2} mg/m^3	
Self-Contained Breathing Apparatus or Supplied-Air Respirator with Escape Bottle		6×10^{-3} mg/m^3	1×10^{-2} mg/m^3	2×10^{-2} mg/m^3	4×10^{-2} mg/m^3	1×10^{-1} mg/m^3	
Vapor Screening Limit							1×10^{-5} mg/m^3

Notes:

[a] Exposures at the STEL shall not occur more than one time per day.

Airborne exposure limits (AELs) are taken from the CMA MCP and 68 FR 58348-58351 (9 October 2003).

All AELs are concentration and time values, not concentration only values. Administrative controls may be used to limit potential exposure to workers. However, because administrative controls cannot be used to limit the duration of potential public exposure, only the worker population limit (WPL) protective action level is significantly affected by administrative controls, which limit the duration of potential exposure.
The maximum use concentration is the product of the AEL and the assigned protection factor for the respirator. The assigned protection factors used in this table are taken from 68 FR 34036-34119.

Table E-3. GD AELs

GD	Averaging Time						
	GPL (72 hours)	WPL (12 hours)	WPL (8 hours)	WPL (4 hours)	WPL (2 hours)	STEL (15 minutes)	Variable
General Population	1×10^{-6} mg/m^3						
No Respiratory Protection		3×10^{-5} mg/m^3	3×10^{-5} mg/m^3	3×10^{-5} mg/m^3	3×10^{-5} mg/m^3	3×10^{-5} mg/m^3	
Air-Purifying Respirator		1.5×10^{-3} mg/m^3	1.5×10^{-3} mg/m^3	1.5×10^{-3} mg/m^3	1.5×10^{-3} mg/m^3	1.5×10^{-3} mg/m^3	
Supplied-Air Respirator w/o Escape Bottle		3×10^{-2} mg/m^3	3×10^{-2} mg/m^3	3×10^{-2} mg/m^3	3×10^{-2} mg/m^3	3×10^{-2} mg/m^3	
Self-Contained Breathing Apparatus or Supplied-Air Respirator with Escape Bottle		3×10^{-1} mg/m^3	3×10^{-1} mg/m^3	3×10^{-1} mg/m^3	3×10^{-1} mg/m^3	3×10^{-1} mg/m^3	
Vapor Screening Limit							3×10^{-5} mg/m^3

Notes:

Airborne exposure limits (AELs) are taken from the CMA MCP and DA Pam 385-61.

All AELs are concentration only values, regardless of duration. Personal protective equipment (PPE) may be used to limit potential exposure to workers.

The maximum use concentration is the product of the AEL and the assigned protection factor for the respirator. The assigned protection factors used in this table are taken from 68 FR 34036-34119, 6 June 2003.

Table E-4. GB AELs

GB	Averaging Time						
	GPL (24 hours)	WPL (12 hours)	WPL (8 hours)	WPL (4 hours)	WPL (2 hours)	STEL[a] (15 minutes)	Variable
General Population	1×10^{-6} mg/m^3						
No Respiratory Protection		2×10^{-5} mg/m^3	3×10^{-5} mg/m^3	6×10^{-5} mg/m^3	6×10^{-5} mg/m^3	1×10^{-4} mg/m^3	
Air-Purifying Respirator		1×10^{-3} mg/m^3	1.5×10^{-3} mg/m^3	3×10^{-3} mg/m^3	3×10^{-3} mg/m^3	5×10^{-3} mg/m^3	
Supplied-Air Respirator w/o Escape Bottle		2×10^{-2} mg/m^3	3×10^{-2} mg/m^3	6×10^{-2} mg/m^3	6×10^{-2} mg/m^3	1×10^{-1} mg/m^3	
Self-Contained Breathing Apparatus or Supplied-Air Respirator with Escape Bottle		2×10^{-1} mg/m^3	3×10^{-1} mg/m^3	6×10^{-1} mg/m^3	6×10^{-1} mg/m^3	1 mg/m^3	
Vapor Screening Limit							1×10^{-4} mg/m^3

Notes:

[a] Exposures at the STEL shall not occur more than four times per day, and at least 60 minutes must lapse between successive exposures.
[b] Implemented as a ceiling value.

Airborne exposure limits (AELs) are taken from the CMA MCP and 68 FR 58348-58351 (9 October 2003).

Table E-4. GB AELs (Continued)

Notes: (Continued)

All AELs are concentration and time values, not concentration only values. Administrative controls may be used to limit potential exposure to workers. However, because administrative controls cannot be used to limit the duration of potential public exposure, only the WPL protective action level is significantly affected by administrative controls, which limit the duration of potential exposure.

The maximum use concentration is the product of the AEL and the assigned protection factor for the respirator. The assigned protection factors used in this table are taken from 68 FR 34036-34119, 6 June 2003.

GB = sarin
GPL = general population limit
mg/m^3 = milligram per cubic meter
STEL = short-term exposure limit
WPL = worker population limit

2. ORGANIZATION AND MANAGEMENT RESPONSIBILITIES

EDS operations at DPG will require collaborative efforts between several government agencies.

2.1 CMA

CMA is responsible for the following:

- Developing and coordinating all plans and procedures required for EDS operations
- Ensuring that appropriate review and approval of EDS procedures is obtained from the Department of the Army (DA) and outside agencies
- Implementing a quality assurance (QA) program
- Ensuring Occupational Safety and Health Administration (OSHA) and DA health and safety requirements are met
- Overseeing agent treatment and certifying treatment is complete.

2.2 CMA-Monitoring Office

The CMA-Monitoring Office is responsible for:

- Notifying outside agencies such as the Department of Health and Human Services (DHHS) of monitoring results

- Defining laboratory and monitoring QA requirements for monitoring activities

- Advising the Project Manager for Non-Stockpile Chemical Materiel (PMNSCM) on laboratory-related quality assurance/quality control (QA/QC) practices

- Recommending QA/QC practices for PMNSCM to use in supporting the EDS monitoring activities

- Reviewing and evaluating this Site-Specific Monitoring Plan (SSMP) and quality control (QC) plans

- Monitoring the effective implementation of this SSMP at the DPG EDS site

- Reviewing QC data and recommending remediation, as required.

2.3 PMNSCM

The PMNSCM is responsible for:

- Developing and coordinating all activities to be conducted at the DPG EDS site

- Coordinating necessary support between DPG and ECBC during DPG EDS operations

- Providing technical oversight and assistance for DPG EDS operations

- Ensuring that all agent transportation, storage, treatment, repackaging, and closure operations are conducted in compliance with Federal, State, and local laws, and Army and other applicable regulations.

2.4 ECBC

Monitoring will be conducted by the ECBC Monitoring Branch. ECBC will:

- Collect and retain all monitoring data and monitoring QC data generated during the project.

- Provide guidance for monitoring operations conducted onsite.

- Provide trained and certified personnel to set up, calibrate, and challenge monitoring equipment and collect monitoring and waste screening samples.

- Provide calibration and challenge research development, test, and evaluation (RDT&E) standards for chemicals of concern.

- Perform monitoring procedures outlined in this plan.

- Provide an operational mobile analytical platform (MAP) configured with instrumentation capable of analyzing Depot Area Air Monitoring System (DAAMS) tubes.

2.5 DPG

During closure operations, the DPG laboratory will perform confirmation agent analysis for all wastes.

3. MONITORING STRATEGIES

Placement of each monitoring location is based on potential chemical migration points and verified via the use of a smoke test. When monitoring supports personnel protection, monitoring locations should be located in close proximity of personnel and preferably at the breathing zone height. Heat-traced sample lines (HTSLs) will be no more than 150 feet in length. All critical near real-time (NRT) monitoring equipment will be connected to an uninterruptible power supply.

During DPG EDS treatment operations, monitoring will be conducted based on the agent being treated during that specific chemical agent campaign. NRT monitoring for HD[1] will be conducted with MINICAMS units equipped with flame photometric detectors (FPDs) or halogen selective detectors (XSDs), and monitoring for GB, GD, and VX[2] will be conducted with MINICAMS units equipped with FSDs. Additionally, confirmation DAAMS tubes will be co-located at each NRT monitoring location.[3] Historical DAAMS samples will be collected in locations of most likely potential for exposure for individuals with no respiratory protection.[4]

Table E-5 specifies the monitoring application and type of monitor to support each application. The monitoring types discussed in the following paragraphs will be employed during DPG EDS treatment operations.

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1 HT will be monitored as HD.

2 When monitoring for VX, a silver fluoride pad will be installed at the distal end of each HTSL. At a minimum, a silver fluoride pad will be changed weekly.

3 When collecting DAAMS tubes for VX detection, a silver fluoride pad will be installed at the distal end of each sampling location. At a minimum, silver fluoride pads will be changed weekly. When collecting DAAMS tubes for HD detection, a nitrogen oxide (NO_x) filter will be installed at the distal end of each sampling location.

4 See footnote 3.

Table E-5. Monitoring Application and Monitor Type

Analyte	Monitor/Equipment	Notes
NRT Monitoring		
HD/HT[a]	MINICAMS®	MINICAMS configured with a PCT and XSD or FPD
GB, GD, VX	MINICAMS	MINICAMS configured with a PCT and FPD
Confirmation of NRT Alarm and Historical Monitoring		
HD, GB, GD, VX	DAAMS; GC/MS or GC/FPD	Qualitative confirmation of the MINICAMS alarm and quantitative historical DAAMS
Historical Monitoring		
HD, GB, GD, VX	DAAMS; GC/MS or GC/FPD	Quantitative analysis

Notes:

[a] HT will be monitored as HD.

DAAMS = Depot Area Air Monitoring System
FPD = flame photometric detector
GB = sarin
GC/MS = gas chromatograph/mass spectrometer
GD = soman
HD = distilled sulfur mustard
HT = thickened mustard
NRT = near real-time
PCT = preconcentrator tube
VX = O-ethyl S-(2-diisopropylaminoethyl)methylphosphonothioate
XSD = halogen selective detector

3.1 NRT/Confirmation

NRT/confirmation locations shall consist of an instrument that satisfies the 15-minute or less monitoring requirement identified for NRT monitors and shall also incorporate a confirmation monitoring method. At a minimum, confirmation monitoring shall consist of a qualitative method as defined in the CMA MCP and LMQAP. The confirmation method shall be capable of confirming a single cycle NRT alarm response. When NRT monitoring is coupled with a confirmation method and chemical materiel is confirmed, the NRT measured concentration shall be the value of record.

3.2 Historical/Confirmation

Historical monitoring will be performed by DAAMS sampling and subsequent analysis by gas chromatograph/mass spectrometer (GC/MS) or gas chromatograph/flame photometric detector (GC/FPD). A separate confirmation method is not required when GC/MS is employed.

4. MONITORING EQUIPMENT

As identified in **Table E-5**, the chemicals of concern will be monitored using the following equipment:

- MINICAMS
- DAAMS tube sample collection followed by analysis with GC/MS or GC/FPD.

The MINICAMS is considered an NRT agent monitor. DAAMS is used as a historical method and for confirmation of NRT alarms and historical concentrations greater than

the reportable limit(s). The following paragraphs describe the monitoring equipment in more detail.

4.1 MINICAMS Equipment Description

The MINICAMS is an automated gas chromatograph (GC) that operates by alternating between sampling and analysis cycles. During the sample cycle, a vacuum system pulls an air sample into the MINICAMS via an HTSL. The sampling and analysis cycle of the MINICAMS shall be no more than 15 minutes.

4.1.1 MINICAMS Configuration. The air sample enters the MINICAMS and concentrates on a solid sorbent tube (that is, preconcentrator tube). The sorbent tube is maintained at a temperature that will prevent condensation from forming on the sorbent tube. During sample analysis, the solid sorbent tube is heated to thermally desorb the analytes, while nitrogen flows into the sorbent tube to sweep the analytes into the capillary column for analytical separation. Analytes undergo chromatographic separation and are carried to the detector for sample analysis.

4.2 DAAMS Equipment Description

DAAMS tubes are used to confirm agent MINICAMS alarms and to provide historical monitoring at WPL Levels. The DAAMS stations are comprised of solid sorbent DAAMS tubes, sample manifolds, sequencers, pumps, and flow control devices. Air monitoring with DAAMS employs air aspiration through the DAAMS tube for a predetermined period of time at a controlled airflow rate. Contaminants in the air are adsorbed on the solid sorbent. Aspirated DAAMS samples are then analyzed in the laboratory to detect chemical materiel at the prescribed monitoring levels. Laboratory analysis uses thermal desorption of the analytes from the sorbent tubes into a GC/MS or GC/FPD.

5. MONITORING SYSTEMS

The following paragraphs describe the monitoring systems that will be employed during DPG EDS operations. Monitoring locations during chemical agent operations are illustrated in **Figure E-1**.

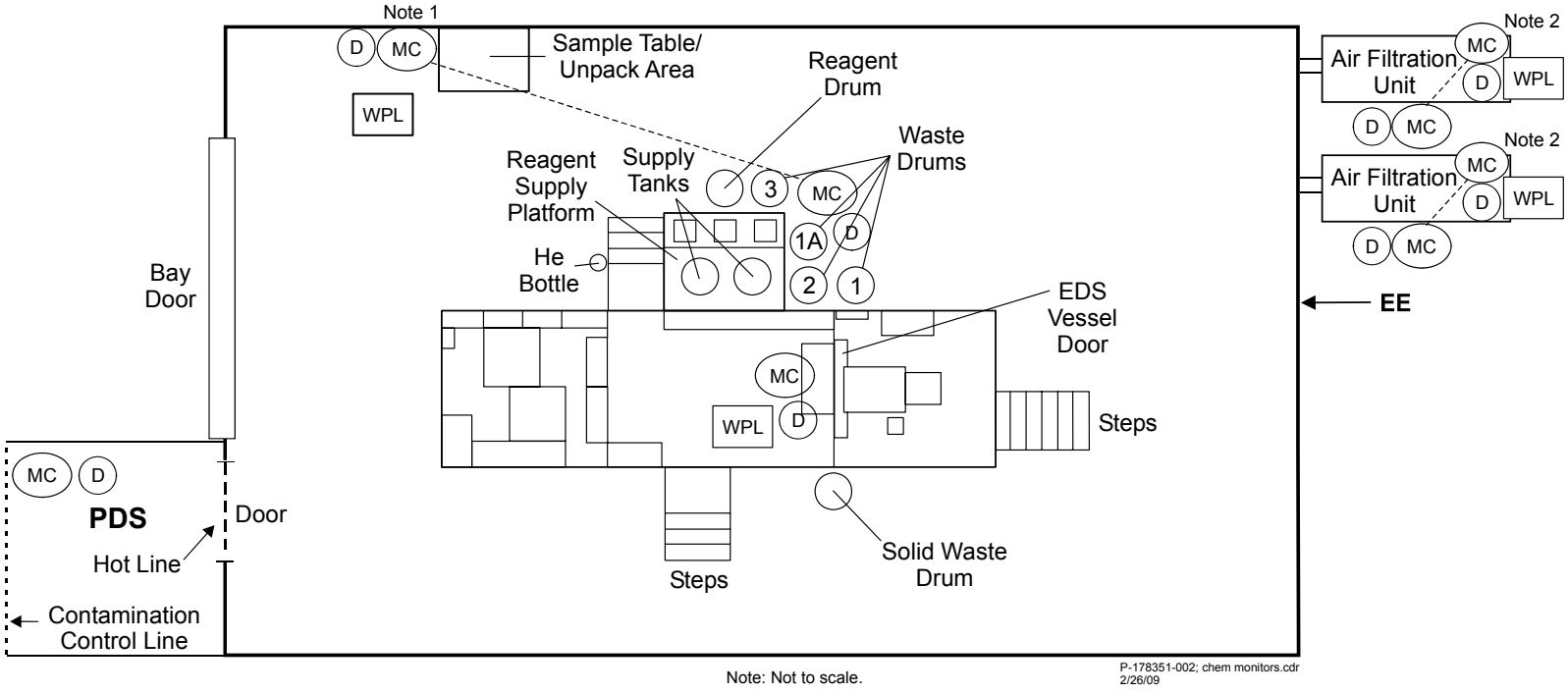
5.1 NRT Monitoring

NRT monitoring is online monitoring, conducted in areas where contamination is likely or possible, to determine an airborne chemical concentration in the shortest amount of time at the monitoring level commensurate with engineering controls and worker protection. NRT monitoring will take place at the locations discussed in the following paragraphs. **Table E-5** details the MINICAMS configurations for monitoring chemical agents.

5.1.1 EDS Containment Vessel. NRT monitoring at the Containment Vessel will be performed using an HTSL interfaced with a MINICAMS located in the monitoring shed. The HTSL will be coiled and hung over the Containment Vessel such that it is less than 2 feet above and slightly in front of the Containment Vessel door. NRT monitoring at this location will be performed at the STEL.

5.1.2 Air Filtration Unit. NRT monitoring will be performed at both the midbed and the postbed (stack) locations of the air filtration unit. Monitoring will be performed using an HTSL interfaced with a MINICAMS (at each location) located in the monitoring shed. NRT monitoring will be performed at these locations continuously at the vapor screening level (VSL).

5.1.3 Sample Area/Unpack Area or Above Waste Drums. By employing the use of stream selection devices, a single MINICAMS for each agent will have the capability of switching sampling locations between the sample area/unpack area and above the



D = DAAMS sampling point

MC = MINICAMS® sampling point

WPL = WPL DAAMS sampling point

Note 1. According to the operation being performed, a single MINICAMS unit equipped with a Stream Selection System will be used to monitor either the unpack area or over the waste drums. The Stream Selection System will be manually switched, but in the event of an NRT alarm, will lock on the location of the alarm.

Note 2. Each air filtration unit will be monitored with a single MINICAMS unit equipped with a Stream Selection System. The normal monitoring locations will be at the midbed location of each air filtration unit. In the event of an alarm at either midbed location, the Stream Selection systems will be manually switched to monitor the stack locations.

Figure E-1. Chemical Agent Monitoring Locations

waste drums. The stream selection will be manually switched depending on the procedure being performed.

NRT monitoring of the sample area/unpack area will be performed using an HTSL interfaced with a MINICAMS located in the monitoring shed. The HTSLs will be coiled and hung over the table in the unpack area such that it is less than 2 feet above the unpack table. NRT monitoring at this location will be performed at the STEL.

NRT monitoring of the waste drum area will be performed using an HTSL interfaced with a MINICAMS located in the monitoring shed. The HTSL will be coiled and hung over the waste drums such that it is less than 2 feet above the drums. NRT monitoring at this location will be performed at the STEL.

5.1.4 Personnel Decontamination Station (PDS). In the event of a potentially exposed worker, MINICAMS will be available to conduct NRT monitoring in the PDS. NRT monitoring at this location will be at the STEL.

5.2 Confirmation Monitoring

Confirmation monitoring is performed to validate or invalidate a positive measurement from another monitoring system, either an NRT method or historical method. Sampling is accomplished by the collection of an air sample in the immediate vicinity of the NRT monitor or historical sampling location, and subsequent analysis is conducted offline at the site laboratory. Confirmation monitoring is used for informational and qualitative data reporting purposes in the event of a chemical materiel release. The confirmation sample, if required, shall be analyzed by a method different from the principal method (NRT or historical) to increase the likelihood of detecting interferences and only upon a principal method (NRT or historical) positive response. Confirmation monitoring samples shall be given priority over all routine samples.

Confirmation monitoring equipment during chemical agent operations will be collocated at all NRT monitoring locations.

Confirmation DAAMS tubes are continually aspirated throughout the work day. In the event of an NRT alarm, the DAAMS tubes collocated with the alarming MINICAMS are collected and analyzed.

Note: When using a DAAMS GC/MS historical method, a separate confirmation method is not required.

5.2.1 EDS Containment Vessel. DAAMS tubes samples will be used for qualitative confirmation analysis of chemical agents. The sample inlet will be collocated with the MINICAMS HTSL distal end. When the collocated MINICAMS alarms, the DAAMS tube will be retrieved and analyzed to confirm or dismiss the alarm.

5.2.2 Air Filtration Unit. DAAMS tubes will be used for qualitative confirmation analysis of chemical agents. The sample inlet will be collocated with the MINICAMS HTSL distal end. When the collocated MINICAMS alarms, the DAAMS tube will be collected and retrieved to confirm or dismiss the alarm.

5.2.3 Unpack Area. DAAMS tubes samples will be used for qualitative confirmation analysis of chemical agents. The sample inlet will be collocated with the MINICAMS HTSL distal end. When the collocated MINICAMS alarms, the DAAMS tube will be collected and retrieved to confirm or dismiss the alarm.

5.2.4 Waste Drums. DAAMS tubes samples will be used for qualitative confirmation analysis of chemical agents. The sample inlet will be collocated with the MINICAMS HTSL distal end. When the collocated MINICAMS alarms, the DAAMS tube will be retrieved and analyzed to confirm or dismiss the alarm.

5.2.5 PDS. DAAMS tubes samples will be used for qualitative confirmation analysis of chemical agents. The sample inlet will be collocated with the MINICAMS HTSL distal end. When an area alarm occurs at this MINICAMS location, the DAAMS tube(s) will be retrieved and analyzed to confirm or dismiss the alarm.

5.3 Historical Monitoring

Historical monitoring is performed to measure very low concentrations of airborne analytes at the WPL, where contamination is unlikely or workers are operating without PPE. Sampling is accomplished by the collection of an air sample over an extended period of time (usually the duration of a workday) and subsequent analysis is conducted offline at the site laboratory. Historical monitoring is designed to trigger activities to investigate the source of contamination that may be found below the alarm level of the NRT system. All historical DAAMS samples must be analyzed within 72 hours of sampling termination.

During agent operations (whenever unmasked workers are in the EE), historical DAAMS stations will be located above the unpack/sample table and above the EDS vessel.

An additional DAAMS sampling station will be located at the filter exhaust and will sample at all times during agent operations. Monitoring will be performed at the WPL (8-hour WPL for no respiratory protection). Because the chemical agents will be processed in campaigns, monitoring in this location in the air filtration unit will normally be conducted for the chemical agent being processed in the current campaign. However, in the event there is a confirmed NRT alarm in the EE during an earlier campaign, then the agent that resulted in the alarm will continue to be monitored in this location throughout all subsequent agent campaigns. This could result in the monitoring of more than one agent in this location.

5.4 Vapor Screening

As a minimum, headspace monitoring shall be implemented on all solid process samples and liquid process sample containers prior to shipment to the laboratory. Vapor screening will be conducted in accordance with ECBC IOPs and Department of the Army Pamphlet (DA Pam) 385-61.

Vapor screening can be performed with either MINICAMS or DAAMS tubes. If results provide a concentration greater than 0.7 VSL, corrective actions shall be implemented (confirmation, repeat decontamination process and re-monitor, etc.).

6. REPORTING POSITIVE CHEMICAL MATERIEL RESPONSES

All worker and environmental protection MINICAMS alarms will require confirmation analysis. MINICAMS alarm confirmation will be performed by collection and analysis of a DAAMS tube sample.

6.1 Monitoring Levels

Monitoring at the STEL will be performed in areas where worker protection monitoring is required. If the NRT sampling and analysis cycle time is less than 15 minutes, the STEL, excursion is manually calculated using the concentration reported by the NRT monitor.

The VSL (also known as vapor screening limit) is intended for applications and/or locations that require monitoring for an environmental release, engineering controls (for example, filters), process upset condition, or vapor decontamination classification monitoring. The VSL is a concentration-only value and does not consider the analysis method's sampling duration other than to determine the volume of air sampled to calculate the analyte concentration.

6.2 MINICAMS Alarm Setpoints

During EDS operations at DPG, the following alarm levels will be used:

- 0.7 Z will be used in all areas where worker protection is being performed (all locations inside the EE and the PDS)

- 0.5 Z will be used in all process monitoring areas (within the air filtration units).

6.3 NRT Notifications

In the event of an alarm, the MINICAMS operator will notify the EDS System Manager and Crew Chief. In addition, the DPG Site Safety and Health Officer (SSHO) may be notified, depending on the situation. **Table E-6** lists several possible scenarios, persons to be notified, and possible actions to be taken.

6.4 Confirmation and Historical Notifications

The support laboratory will notify the EDS System Manager of the results of all DAAMS tube analyses. If the samples were confirmation samples, the EDS System Manager will notify the DPG Safety Office of the results. If the samples were analyzed only for historical purposes, the EDS System Manager will notify the DPG Safety Office only if agent was detected. The PMNSCM EDS System Manager will be notified of all detections and confirmed detections of chemical agent. **Table E-7** is the DAAMS tube analysis matrix.

Table E-6. NRT Notification Matrix

Situation	Notification	Possible Action[a]
Single MINICAMS® Alarm	• EDS System Manager and EDS Crew Chief • ECBC SSHO • DPG Safety Office	• Await result of next MINICAMS cycle • Evacuate non-essential personnel • Evaluate PPE • Analyze DAAMS tubes
Two Consecutive MINICAMS Alarms	• EDS System Manager and EDS Crew Chief • DPG Safety Office • ECBC SSHO	• Await result of next MINICAMS cycle • Evaluate PPE • Determine source of contamination
Three Consecutive MINICAMS Alarms	• EDS System Manager and EDS Crew Chief • DPG Safety Office • ECBC SSHO	• Determine source of contamination • Relocate filtration system MINICAMS sample point from prefilter location to post-bed location (if alarm occurs at the prefilter and the midbed MINICAMS and/or a confirmed midbed alarm occurs)

Notes:

[a] This table is based on detection of chemical warfare materiel (CWM) at the alarm setpoint. Decision on actual actions taken will reside with the EDS System Manager. Actions may vary, depending on the actual concentration of CWM detected.

DAAMS = Depot Area Air Monitoring System
DPG = Dugway Proving Ground
EDS = Explosive Destruction System
PPE = personal protective equipment

Table E-7. DAAMS Tube Analysis Matrix

Response To	Location/Scenario	DAAMS Tube Analysis Sites
MINICAMS® Alarm	EE	Co-located confirmation DAAMS tubes
MINICAMS Alarm	Midbed carbon filter position in EE air handling unit	Co-located confirmation DAAMS tubes
Contingency	Visually observe item leaking inside EE (outside of EDS vessel)	All historical DAAMS stations in EE and EE exhaust filtration system
Contingency	Failure of engineering controls in EE	All historical DAAMS stations in EE and EE exhaust filtration system
Quality Assurance Requirement		Each day of destruction operations at least one – • DAAMS tube from above the door of the EDS vessel

Notes:

DAAMS = Depot Area Air Monitoring System
EDS = Explosive Destruction System
EE = Environmental Enclosure

6.5 WPL Excursions

In the event of a WPL excursion, the *Chemical Agent Worker Population Limit Excursion Plan for the Explosive Destruction System at Dugway Proving Ground* will be implemented. The Excursion Plan is provided in **Annex J** of the EDS at DPG Destruction Plan.

7. MONITORING OF POTENTIALLY EXPOSED WORKERS

Monitoring of potentially exposed workers will be conducted in accordance with the DA Memorandum: *Performance Standard for Monitoring Potentially Exposed Workers*, 13 September 2007.

8. DOCUMENTATION

8.1 General Monitoring Documentation

During operations, ECBC personnel will maintain documentation of all monitoring activities. The documentation will include activity information on daily air monitoring, sample records, chain-of-custody (COC) forms or transfer of possession, sample analysis records, equipment calibration, equipment maintenance records, agent response, and Standing Operating Procedures (SOPs) and/or Internal Operating Procedures (IOPs) for air monitoring and laboratory analysis.

8.2 Equipment Documentation

All support laboratory analytical equipment information will be documented by ECBC support laboratory personnel. The laboratory will document and maintain all acceptance test results for the equipment. Information regarding each instrument is documented in logbooks, an electronic database, or other applicable format.

8.3 Reference Standards

RDT&E dilute CASARM solutions will be used. Agent standards received by the agent custodian or designated alternates will be accounted for, undamaged, and properly labeled at all times.

9. TRAINING REQUIREMENTS

All EDS monitoring personnel are required to meet the minimum training requirements outlined in the OSHA standard 29 Code of Federal Regulations (CFR) 1910.120 covering Hazardous Waste Operations and Emergency Response (HAZWOPER). ECBC personnel will perform all monitoring and analytical operations at the site.

All monitoring personnel must also meet the training criteria detailed in the ECBC LMQCP.

10. QC REQUIREMENTS

All monitoring operations will be conducted in accordance with the ECBC LMQCP, the CMA LMQAP, and applicable IOPs. ECBC will incorporate the data generated into the monitoring 40-year data storage program, should access to additional information be required. QC requirements for applicable ECBC IOPs (IOP MT-16, IOP MT-02, and IOP MT-13) are provided in **Tables E-8** and **E-9**, respectively.

10.1 Certification Requirements

The laboratory shall perform a certification and validation process for operators, instruments, and methods to confirm that analytical processes are suitable for use.

Method certification will require completion of a successful precision and accuracy (P&A) study and initial baseline study. Method certification will be required before the method can be used in support operations. Method validation will be demonstrated through the continuous baseline study.

10.1.1 P&A Method Certification. All NRT and historical agent methods will be certified as Class I methods via P&A studies in accordance with the LMQCP. Confirmation methods will be certified as Class III methods via P&A studies. P&A studies will be performed onsite at DPG prior to the pre-operational survey for data evaluation by the CMA-Monitoring Office.

10.1.2 Baseline Method Certification and Validation. All methods shall successfully satisfy the initial alternate baseline study method certification requirements as shown in Table 13-4 of the CMA LMQAP before the methods are allowed to support operations.

Table E-8. QC Requirements for IOP MT-02[a]

QC Sample	Frequency	Acceptance Limits	Corrective Action
Sampling Flow Rate Measurements	During calibration	HD, HT: 400 ±100 mL/min GB, GD, VX: 800 mL/min ±200 mL/min	Adjust and recheck before starting calibration and analysis.
Initial Calibration (ICAL) 1 High-level Challenge (1.0 STEL)	Start of each operational day or after failing midday challenge	0.75 to 1.25 STEL	Investigate and correct cause. Repeat ICAL if required.
Continuing Calibration Verification (CCV) – Also Called Challenge 1 Low-level Challenge (0.25 STEL)[b]	After every 4 to 5 hours of operation and at the end of operational day	Low: 0.75 to 1.25 STEL	Investigate and correct cause. Repeat ICAL if failure is for midday challenge. No action if failure is at the end of the day. Note on data forms.

Notes:

[a] Operation and Maintenance Procedures for Fixed Site MINICAMS®
[b] Distal end line challenges will be performed on a weekly basis. Acceptance limits will be 0.75 to 1.25 STEL.

Method is for one-of-a-kind, near real-time samples. Reanalysis not possible for QC failures.

GB = sarin
GD = soman
HD = distilled sulfur mustard
HT = thickened mustard
mL/min = milliliter per minute
QC = quality control
STEL = short-term exposure limit
VX = O-ethyl S-(2-diisopropylaminoethyl)methylphosphonothioate

Table E-9. QC Requirements for IOP MT-13[a]

QC Sample	Frequency	Acceptance Limits	Corrective Action
Sampling Flow Rate Measurements	Before and after sample collection	Starting and ending flow rates within 10% of the average flow rate	Repeat sampling unless samples are one of a kind. If one of a kind, flag data.
Five Point Initial Calibration (ICAL)	When instrument parameters change After preparation of new standards When ICV or CCV fails	R2 $\geq$0.99	Investigate and correct the cause. Repeat ICAL.
Initial Calibration Verification (ICV)	At the start of each day of analysis After ICAL	Each target analyte ±15% of true value	Recalibrate.
Continuing Calibration Verification (CCV)	At the end of a sample run or every 12 hours, whichever is shorter	Each target analyte ±15% of true value	If result >115% of true value, recalibrate. Sample results may be reported. If result <85% of true value, recalibrate. Analyze second sample tube for each sample analyzed since the last passing CCV.
Method Blank	At least one before analyzing samples	Absence of target analytes and interferences	Investigate and correct. Repeat method blank to verify acceptable performance.
Quality Process (QP) – Similar to Matrix Spike	1 each per batch of 20 or fewer samples	Recovery $\geq$10% (Note: Agent-specific limits are currently under development.)	Verify spiking solutions. Analyze second QP tube. If results are confirmed, spike and analyze second sample tube from location where QP was taken. Ensure acceptance limits met. Flag data.

Notes:

[a] Analysis of Chemical Warfare Agents and Degradation Products on DAAMS Tubes using a Gas Chromatography System Coupled with a Mass Selective Detector

QC = quality control

During the initial baseline studies, all sampling and analysis operations shall be performed exactly as set forth in the applicable analytical procedures under similar operating conditions for instruments shown to be in control. The alternate initial baseline study will consist of one challenge event, following calibration at the beginning of the operational workday, then not less than three challenge events per station per day with a challenge event every 2 to 3 hours. The alternate baseline will be conducted for 3 consecutive days.

The continuing baseline study will be conducted to validate long-term performance of the monitoring systems. The continuing baseline study begins immediately after successful completion of the initial baseline. An alternate continuing baseline study will consist of a challenge every 4 to 5 hours and at the end of the workday or operation, each day of operations.

For monitoring cessation greater than 60 days, three 1-day initial and continuing baselines will be repeated. For monitoring cessation less than 60 days, method re-certification baselines shall be performed in accordance with CMA LMQAP, Table 10-5.

10.2 Calibration and Test Methods

The laboratory shall have an established calibration program. Air monitoring methods shall undergo calibration in accordance with ECBC IOPs. This plan shall define the calibration requirements for chemical materiel methods, including physical measurement equipment or other laboratory equipment that validates a measurement.

The calibration plan shall have documented instructions on using and operating all relevant equipment, handling and preparing calibration items, and calibrating equipment. All instructions, standards, manuals, and reference data relevant to the monitoring or laboratory operation shall be maintained up-to-date and be readily

available to staff and auditors. The laboratory and monitoring staff shall use documented procedures and legally defensible statistical techniques to select representative samples for analysis, where applicable.

All calculations and data transfer performed in support of solution preparation, calibration, and sample analysis shall be documented on a calculation sheet, signed, and checked by a separate person. The validator shall sign the calculation sheet once it is deemed accurate.

Where computers or other automated equipment are used to capture, process, manipulate, record, report, and/or store or retrieve calibration or test data, the laboratory shall ensure the following: (1) the computer software is documented, fully tested, and adequate for use, (2) computer and automated equipment is maintained to ensure proper functioning and is provided with the environmental and operating conditions necessary to maintain its integrity, (3) procedures are implemented to protect data integrity, (4) appropriate and up-to-date virus protection is in use, and (5) previous releases of software packages are maintained if data reprocessing is required.

EDS personnel shall establish and implement appropriate procedures for the maintenance and security of data, including the prevention of unauthorized access to and amendment of computer records.

10.2.1 Performance Charts. The laboratory may use performance charts for internal QC tracking. A performance chart is a graphical plot of challenge results with respect to time or sequence of challenges, with limits drawn within which results are expected to lie when the analytical scheme is in a state of “performance control.” In addition to identifying methods or instrumentation that are out of “performance control,” the chart discloses any trending.

10.3 QC Sampling

All instruments used for the analysis of chemical agents shall be subject to periodic QC sample analysis to check the process from sample collection through analysis. The QC samples are also used to:

- Evaluate the accuracy and precision of analytical data to establish the quality of the data.
- Provide an indication of the need for corrective actions.
- Determine the effectiveness of corrective actions when they are implemented.

The laboratory and monitoring staff that supports EDS operations uses numerous types of QC samples to inspect the measurement process. QC samples provide data that can validate the results of the analysis of an actual sample. The following types of QC samples are used by the laboratory staff during EDS operations:

- Blanks
- Replicates
- Calibration checks
- Matrix spikes (MSs)
- Field spikes (quality plant [QP])
- Laboratory spikes (quality laboratory [QL]).

Detailed definitions and descriptions of QC samples are available in the CMA LMQAP. Limiting Conditions of Operation (LCOs) can also be found in the LMQAP.

10.3.1 NRT Methods. All NRT methods used during operations will be challenged via QP samples according to the frequency identified in the CMA LMQAP. The QP challenge shall deliver agent to the instrument at 1.0 STEL.

10.3.2 Historical/Confirmation Methods.

10.3.2.1 QP Samples. All historical/confirmation methods will be challenged via QP samples in accordance with the CMA LMQAP, Table 13-4. Confirmation QP samples must be analyzed within 72 hours of sample termination.

A QP sample challenge failure will require corrective action and additional daily QP challenges until the problem is resolved. These QP challenges will not be included in the baseline studies, but will be included in the corrective action report.

10.3.2.2 QL Samples. All laboratory instruments used for analysis as part of historical or confirmation methods shall be challenged with QL samples (initial calibration verification [ICV] or continuous calibration verification [CCV] samples) to assess the laboratory's cross-contamination and bias.

10.3.3 In-Control Criteria and Notification. The term in-control is used to indicate that the laboratory and monitoring analytical activities are within the pre-established statistical control limits and meet baseline study requirements. When instrumental methods are in-control, the analytes are detected and accurately quantitated if present in a sample. To protect personnel at the site, the monitoring equipment must be operating and in control before operations start each day and remain in control for the operational period. The EDS personnel report to the EDS Site Manager the status of the monitoring and analytical instrumentation on a daily basis. ECBC will record the

control status of the laboratory and monitoring equipment in a daily operational log. If the laboratory or monitoring equipment is determined to be out of control, or if control status is questionable, then the EDS Site Manager will be notified immediately. This ensures that agent concentrations above or equal to the MINICAMS alarm setpoint at sampling locations will be properly detected and quantitated and laboratory equipment will provide unqualified analyses.

10.3.3.1 Monitoring Equipment In-Control Criteria/LCOs. The EDS monitoring equipment is in-control if the following criteria are met:

- The MINICAMS alarm systems have successfully passed their daily initial baseline challenge.
- The alarm confirmation and historical sample stations are online and operating.
- The QC sample results reported back to the site from the laboratory are acceptable.
- The monitoring teams have qualified personnel onsite to maintain monitoring operations in accordance with this SSMP.

10.3.3.2 Laboratory In-Control Criteria/LCOs. The laboratory is in-control if the following criteria are met:

- The instruments that will be used for sample analysis have been calibrated and challenged and meet all performance criteria.
- The samples can be received, stored, prepared, and analyzed in accordance with approved SOPs and this monitoring plan.

- The laboratory is staffed with qualified personnel to prepare samples, perform sample analysis, document and report sample analysis results, and maintain monitoring operations in accordance with this SSMP.

The in-control status of the laboratory will be recorded in the instrument data sheets on a daily basis prior to sample analysis. Traceability will include calibration of analytical instruments and qualifications of the operators.

10.3.3.3 Corrective Action. If a QL result is outside of the acceptable limits, then the method being checked is considered out of control. Another QL sample that duplicates the initial QL sample conditions will be run as soon as possible. Immediate corrective actions will be taken to identify the source of the out-of-control condition. The EDS System Manager or designee will be notified if the laboratory cannot be returned to an in-control status.

10.4 Sample Handling and Storage

All laboratory and monitoring work performed during EDS operations shall follow strict COC procedures. The maintenance of records on the samples collected, received, and analyzed is a critical part of the monitoring program.

The laboratory and monitoring personnel are required to ensure that COC is properly conducted. The receiving chemist will monitor the receipt of samples and compliance with preservation and holding time specifications. Specific procedures will be established by the laboratory and monitoring teams and ECBC under guidelines provided in the following paragraphs.

10.4.1 Shipping Containers and Custody Seals for Nonagent Analysis. Cleaned sample bottles will be sent to the field in shipping containers that will be used for return of samples to the laboratory. Each sample container will contain packing material to

protect the samples from movement during shipment. Individuals collecting samples will follow published U.S. Environmental Protection Agency (USEPA)-approved procedures (SW-846) and site-specific SOPs, as approved by state agencies. The sample collection record will contain, as a minimum: (1) sample identification (ID), (2) date and time, (3) start and stop flow rates or collection times, (4) start and stop times of sampling period, (5) volume of sample, (6) sample location, (7) operator's ID, (8) agent and monitoring level, (9) sample type, and (10) preservative, if any. Deviations from SOPs, security, and unusual environmental conditions shall also be included in the sample collection record.

10.4.2 Sample Identification. A unique sample ID number will be affixed to the sample or sample container. To ensure traceability and uniqueness of the sample identification, the sample ID number should incorporate the sample type, date, and time that the sample was collected. Any deviations from standard procedures shall be noted in the comments section of the sample COC form.

The sample identification system shall be documented, along with a method that relates the field data to the samples. All documentation of the samples shall be performed in permanent ink. If corrections are made to the data, the error will be crossed out once and initialed by the person documenting the data. All field notebooks shall become part of the project files.

10.4.3 Sample COC Documentation. COC documentation will be strictly maintained. Evidence of sample custody shall be traceable from the time the samples are collected until the samples are disposed of after sample analysis. After samples are collected, the COC form will be completed, and the original will be placed in a plastic bag inside the secured sample transport container. Samples identified for analysis by the Organization for the Prohibition of Chemical Weapons will require a custody seal to be affixed to each sample container. A COC form will be forwarded with the samples as they are stored, prepared, analyzed, and finally disposed of in the laboratory. Receipts

from post offices, copies of bills of lading, and airbills will be retained as part of the COC documentation for samples that have been shipped offsite.

10.4.4 Sample Storage. The laboratory shall be responsible for the documentation, security, and maintenance of storage conditions for sample storage.

10.5 Statistical Validation

Statistical validation will be documented in reports including QC data, statistical analysis, and corrective actions. The laboratory will submit the QC data to the CMA mandated statistical program from baseline through closure at https://home.cma.army.mil/qcdrs.

10.5.1 Routine Statistical Reports. Raw data will be submitted to the PMNSCM contractor for data treatment. Reports shall be transmitted via the Web-based statistical software to PMNSCM and CMA-Monitoring Office representative on a monthly basis. These reports will contain information regarding the initial and continuing baseline studies. The laboratory will use the software to produce statistically valid and defensible reports.

10.5.2 Statistical Analysis of Calibration Curve Data. Calibration curve data for the analytical equipment used in the sample measurement process will be analyzed statistically. Once the laboratory has defined the calibration method for an instrument, acceptance criteria for the calibration curve data will also be developed.

The chemical materiel raw calibration data shall be generated from the laboratory specified calibration curves. Algorithms used for calibration curves shall satisfy the calibration requirements specified for each analytical method.

10.5.3 Data Validation. Data validation of laboratory and monitoring data shall be performed routinely to ensure all data are used effectively and in accordance with the approved QC plan. Validation may be performed more frequently when data integrity has been or is suspected to have been compromised. Data captured that does not satisfy applicable data quality objectives (DQOs) will be deemed compromised data. Compromised data must be qualified appropriately and corrective actions shall be implemented to ensure future data have the capability of satisfying applicable DQOs.

The laboratory will define and document proper site validation procedures. To validate analytical and monitoring data, all equations and calculations must be validated during internal audits of the laboratory and monitoring teams. The internal data validation review will be documented in the laboratory or monitoring files, whichever is appropriate. If the internal data validation identifies an error, the CMA-Monitoring Office or designee will be notified. All corrective actions to correct the error shall be documented.

10.6 QC of DAAMS Tubes

New DAAMS tubes shall be subjected to the following tests, or the manufacturer shall supply documentation with each lot purchased, attesting that the lot of DAAMS tubes has been subjected to these tests and meets all requirements. The number of tubes to be pulled for testing is provided in **Table E-10**.

Sampling/acceptance and inspection requirements consist of the following:

- Sample number is in accordance with American National Standards Institute (ANSI)/American Society for Quality Control (ASQC) Z1.4, acceptable quality level of 2.5 percent nonconformance.

Table E-10. Samples Sizes for Normal Inspection for Maximum of 2.5 Percent Nonconformance

Lot or Batch Size	General Inspection Level 1, Number of Samples	Rejection Number[a]
2 to 8	2	1
9 to 15	2	1
16 to 25	3	1
26 to 50	5	1
51 to 90	5	1
91 to 150	8	1
151 to 280	13	2
281 to 500	20	2
501 to 1,200	32	3

Note:

[a] Reject the entire lot if this number of samples is found to be defective.

- Visual inspection for loose packing, warped tube ends, and loose sorbent material

- Pressure-drop test to ensure sufficient airflow through the tube. For DAAMS 6mm tube Tenax® TA, the pressure drop may not exceed 15 inches of mercury (Hg).

10.7 Tube Conditioning

After the representative tubes from a lot pass visual inspection and pressure drop testing, they will be conditioned in a flow of nitrogen at 290°C for 20 minutes, followed by a 5-minute cooling period. All tubes must be conditioned before agent recovery testing.

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APPENDIX E-1
ACRONYMS/ABBREVIATIONS

APPENDIX E-1
ACRONYMS/ABBREVIATIONS

AEL	airborne exposure limit
ANSI	American National Standards Institute
ASQC	American Society for Quality Control
CASARM	Chemical Agent Standard Analytical Reference Material
CCV	continuous calibration verification
CFR	Code of Federal Regulations
CMA	U.S. Army Chemical Materials Agency
COC	chain of custody
DA	Department of the Army
DA Pam	Department of the Army Pamphlet
DAAMS	Depot Area Air Monitoring System
DHHS	Department of Health and Human Services
DPG	Dugway Proving Ground
DQO	data quality objective
ECBC	Edgewood Chemical Biological Center
EDS	Explosive Destruction System
EE	Environmental Enclosure
FPD	flame photometric detector
GB	sarin
GC	gas chromatograph
GC/FPD	gas chromatograph/flame photometric detector

GC/MS	gas chromatograph/mass spectrometer
GD	soman
HAZWOPER	Hazardous Waste Operations and Emergency Response
HD	distilled sulfur mustard
Hg	mercury
HT	thickened mustard
HTSL	heat-traced sample transfer line
ICV	initial calibration verification
ID	identification
IOP	Internal Operating Procedure
LCO	limiting condition of operation
LMQAP	Laboratory and Monitoring Quality Assurance Plan
LMQCP	Laboratory and Monitoring Quality Control Plan for Chemical Materials Agency (CMA) and for Chemical Agent Standard Analytical Reference Material (CASARM)
MAP	mobile analytical platform
MARB	Materiel Assessment Review Board
MCP	Monitoring Concept Plan
MS	matrix spike
NRT	near real-time
OSHA	Occupational Safety and Health Administration
P&A	precision and accuracy
PDS	Personnel Decontamination Station

PINS	portable isotopic neutron spectroscopy
PMNSCM	Project Manager for Non-Stockpile Chemical Materiel
PPE	personal protective equipment
QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
QL	quality laboratory
QP	quality plant
RDT&E	research development, test, and evaluation
SOP	Standing Operating Procedure
SSHO	Site Safety and Health Officer
SSMP	Site-Specific Monitoring Plan
STEL	short-term exposure limit
USEPA	U.S. Environmental Protection Agency
VSL	vapor screening level
VX	O-ethyl S-(2-diisopropylaminoethyl)methylphosphonothioate
WPL	worker population limit
XSD	halogen selective detector

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APPENDIX E-2
REFERENCES

APPENDIX E-2
REFERENCES

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